PATENT COOPERATION TREATY

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REC'D 28 MAR 2006
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P15013-OZI	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/EP2004/053621	International filing date *(day/month/year)* 20.12.2004	Priority date *(day/month/year)* 22.12.2003
International Patent Classification (IPC) or national classification and IPC INV. H04Q7/38		
Applicant TELEFONAKTIEBOLAGET LM ERICSSON (PUBL) et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 8 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in celectronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
24.10.2005	27.03.2006
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Rosenauer, H Telephone No. +49 89 2399-7231

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/053621

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1, 2, 4-13	as originally filed
3, 3a	received on 26.10.2005 with letter of 21.10.2005

Claims, Numbers

1-20	received on 26.10.2005 with letter of 21.10.2005

Drawings, Sheets

1/5, 2/5, 4/5, 5/5	as originally filed
3/5	received on 26.10.2005 with letter of 21.10.2005

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-20
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

A. Citations and remarks in respect of paragraph V:

1 The present invention relates to a method of controlling paging flow in a cellular communications network according to the preamble of **claim 1**, and to a corresponding telecommunications system for controlling paging flow (**claim 10**).

2 **Generally**, in wireless communication systems, the geographical coverage area is subdivided into smaller areas. Those areas comprise a number of base stations and are called location areas. If a call directed to a certain mobile station is received in the cellular communications network, in order to locate the mobile station a paging request is sent to all base stations in the location area in which said mobile station is registered.

A **general problem** with this existing procedure relies in the fact, that the number of paging requests /responses increases with the number of mobile stations in a particular location area which could increase the problem of network congestion.

Document **D1** (US-A-6 275 708) describes a method for counting the number of initiated calls in a particular location area and limiting the number of initiated calls to a value below a predetermined value. For each initiated call a respective timer is started, the number of calls initiated during the runtime of said timer is counted, and when the number of calls initiated during said runtime of the timer exceeds a predetermined threshold, additional calls to be initiated are blocked.

3 A main **disadvantage** related to the above paging method and paging systems is that for each initiated call a separate timer and counter has to provided which can be significant and is therefore resource inefficient.

4 It is an object of the present invention to provide a more resource efficient method and a corresponding telecommunication system for determining the paging load in a cellular communication system.

According to the **essential features of the invention**, the number of ongoing paging transactions is monitored and a counter for ongoing paging transactions is

incremented when a paging request is accepted and decremented when a paging response is returned by a mobile station.

5 The present invention provides the **advantage** of defining a first and a second event that provide a measuring of a paging load, wherein a usage of separate paging related events can achieve a more precise mapping of the system load regarding paging transactions and the processing of a number of timers can be avoided.

6 The subject-matter of the present invention as claimed in respective independent claims 1 and 10 is neither disclosed in, nor rendered obvious by the **remaining prior art documents** cited in the International Search Report since said documents, which merely relate to a very general state of the art of wireless communication systems and related paging control techniques, do **not** describe the method or means according to the particular feature combination of the present invention or part thereof as defined in said respective independent claims 1 and 10.

7 The subject-matter of respective independent claims 1 and 10 therefore is considered to be **new** and to **involve an inventive step**, Article 33 (2) and (3) PCT.

8 As **claims 2 to 9 and 11 to 20** are dependent on respective claims 1 and 10, said claims 2 to 9 and 11 to 20 do **also meet** the requirements of Article 33 (2) and (3) PCT.

9 The present invention is **susceptible of industrial application**. Article 33 (4) PCT.

B. Further remarks:

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in document D1 is not mentioned in the description, nor is this document identified therein.

routed from the Gateway Mobile Services Switching Center receiving the incoming call to the MSC/VLR associated with the location area of the target mobile station. The known mechanism consists in defining (at the operator side) how many roaming number allocations will be permitted for a specific location area at the same time.

However no such mechanism is known for allowing the operator to control the paging flow of other transactions, such as Supplementary Services (SS), Short Message Services (SMS) and LoCation Services (LCS) transactions.

In fact, when a SS, SMS or LCS transaction is received at the MSC/VLR, a paging is ordered and the only way to control the amount of requested paging may be on network level, by controlling the file size of the software that controls the paging mechanism. This handling is however inefficient, because it does not take into account the configuration of the network, in which different location areas have different radio-resource capacities.

In addition, this mechanism cannot protect the radio network from congestion when bursts of paging requests are destined to the same location area, for example when an important athletics event or football match takes place in a stadium.

US patent US-A-6 275 708 discloses a method for counting the number of initiated calls for in a particular visitor location register or in a particular location area and limiting the number of initiated calls to a value below a predetermined value. In the article "Priority Access Service in Cellular and PCS networks" of Chistopher Redding and Carol-Lyn Taylor, published in the ITS Conference papers of the IEEE (Institute of Electrical and Electronics Engineers) Military Communications Conference 2001 a wireless priority service is described in that priority calls are queued when call resources are not immediately available at call set up. When ongoing calls are

terminated, freed call resources are assigned according to a priority level of the queued calls.

Summary of the invention

Aim of the present invention is to overcome the above mentioned drawbacks, particularly by providing a method and a telecommunications system which controls the paging flow at a service node in a more robust way.

Within the scope of this aim, a particular object of the invention is to meet the requirements for either the mobile subscriber, the service provider and the operator.

CLAIMS

1. A method of controlling paging flow in a network for cellular communications, comprising the steps of

(a) at a control node (14c), receiving (305, 310, 315) a request for paging a mobile station;

(b) determining a location area (11c) in which said paging shall be performed;

(c) checking (320) whether the number of paging transactions which are ongoing for the location area (11c) is lower than at least one maximum number of ongoing paging transactions allowed for the location area (11c);

(d) after a determination that said number of ongoing paging transactions is lower than said maximum number, updating (325) the number of ongoing paging transactions for said location area and processing said paging request, wherein

(e) said updating step (325) comprises the step (405) of incrementing at least one counter indicative of said number of ongoing transactions which is comprised in said control node (14c) when a paging request is accepted for processing by the control node (14c), and the step (415) of decrementing said counter when a paging response has been returned by said mobile station.

2. The method of claim 1, wherein it further comprises the step of:

(f) after a determination that said number of ongoing paging transactions is higher than or equal to said maximum number, checking (330) whether said paging request derives from a Location Services request.

3. The method of claim 2, characterized in that it further comprises the step of:

(g) checking (505) whether said Location Services request is a request for last known location of the mobile station.

4. The method of any one of claims 2 or 3, wherein it further comprises the step of:

(h) checking (515) whether said Location Service request comes from an Emergency Center or a Law Enforcement Agency.

5. The method of claim 3, wherein it comprises the step (510) of retrieving information on said last known location from a Visitor Location Register (15).

6. The method of claim 4, wherein it comprises the step (525) of, after a determination that said Location Services request comes from an Emergency Center or a Law Enforcement Agency, serving (535, 325) the paging request with priority.

7. The method of claim 1, wherein said transactions are of at least one kind selected from the group comprising Call Control transactions, Supplementary Services transactions, Short Message Service transactions and Location Services transactions.

8. The method of any one of claims 1 or 7, characterized in that a respective maximum number which is allowed for said location area is defined for transactions of

each of the kind comprising Call Control transactions, Supplementary Services transactions, Short Message Service transactions and Location Services transactions, respectively, said checking step (c) being performed for each kind of transaction.

9. The method of any one of the claims 1 to 8 wherein the control node is a Mobile services Switching Centre or a serving General Packet Radio Services support node.

10. A telecommunications system for controlling a paging flow in a network for cellular communications comprising at least one control node (14c) associated with a location area (11c) serving a mobile station to be paged, the control node (14c) comprising means for receiving paging requests, wherein the system comprises:

memory means (14c, 15) for storing at least one maximum number of ongoing paging transactions allowed for said location area (11c) and for storing the number of ongoing paging transactions;

comparing means for checking whether said number of ongoing paging transactions is lower than said at least one maximum number;

paging means for paging said mobile station in response to an outcome of said comparing means wherein said control node (14c) comprises at least one counter indicative of said number of ongoing transactions, said counter being incremented when a paging request is accepted for processing by the control node (14c) and being decremented when a paging response has been returned by said mobile station.

11. The telecommunications system of claim 10, wherein it comprises Location Services Request determining means for determining whether a paging request received by said control node (14c) derives from a Location Services request.

12. The telecommunications system of claim 10, wherein said Location Services Request determining means are set so as to check whether said Location Services request is a request for last known location of the mobile station.

13. The telecommunications system of any one of claims 10 to 12, wherein said Location Services Request determining means are set so as to check whether said Location Services request comes from an Emergency Center or a Law Enforcement Agency.

14. The telecommunications system of any one of claims 10 to 13, wherein said control nodes (14c) comprises buffer means for temporarily storing said paging request if said Location request is a request coming from an Emergency Center or from a Law Enforcement Agency, said paging means being set so as to serve said paging request with priority.

15. The telecommunications system of claim 10, wherein said memory means comprise stored therein respective maximum numbers indicative of the maximum number of allowed ongoing paging Call Control transactions, Supplementary Services transactions, Short Message Service transactions and Location Service transactions, respectively, said comparing means being set so as said checking is performed for each of said Call Control transactions, Supplementary Services transactions, Short Message Service transactions and Location Service transactions, respectively.

16. The telecommunications system of claim 10, wherein said memory means are comprised in any one of said Mobile Services Switching Center, a Visitor Location Register connected to said Mobile Services Switching Center, a Base Station Controller connected to said Mobile Services Switching Center and serving said location area.

17. The telecommunications system of any one of claims 10 to 16, wherein said comparing means are comprised in said control node.

18. The telecommunications system of any one of claims 10 to 17, wherein said paging means comprise said Mobile Services Switching Center (14c) and a Base Station Controller serving said location area.

19. The telecommunications system according to any one of the claims 10 to 18, wherein said number of ongoing paging transactions is the overall number of ongoing transactions, regardless of the kind of transaction.

20. The telecommunications system of any one of the claims 10 to 19 wherein the control node is a mobile services switching centre or a serving general packet radio services support node.

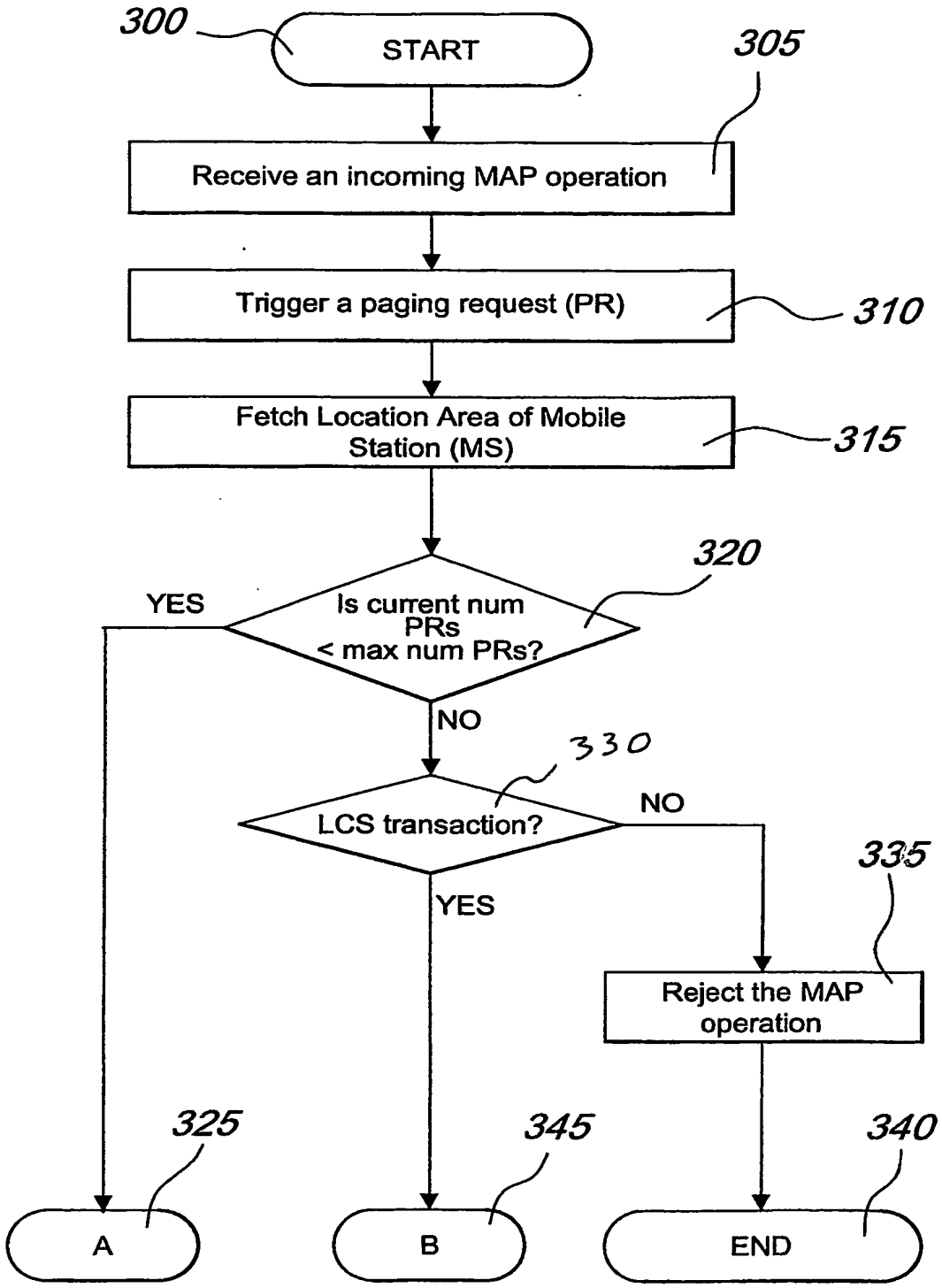
300
START
305
Receive an incoming MAP operation
Trigger a paging request (PR)
310
Fetch Location Area of Mobile Station (MS)
315
320
YES
Is current num PRs < max num PRs?
NO
330
LCS transaction?
NO
YES
335
Reject the MAP operation
325
345
340
A
B
END

Fig. 3